	Office of Safety Regulation of the RPP-WTP Contractor Richland Operation Office, P.O. Box 550, MS A4-70, Richland, WA 99352 Phone (509) 376-4132 Fax (509) 376-3661	**Regulatory Unit**

Meeting Record

IMS: 00-RU-0495

MEETING PURPOSE: The 21th RU/BNFL Topical Meeting: Close-out of Open Issues from Previous Meetings

MEETING DATE/TIME: June 27, 2000 /1:00 – 5:00 PM

MEETING PLACE: Room 142, Federal Building, Richland, WA

AGENDA:
1. RU Opening Remarks
2. BNFL discussion of Open Issues from Previous Meetings

ATTENDEES: See Attachment 1

PREPARED BY: Ko Chen

CONCURRENCE: George Kalman

KEY DISCUSSION ITEMS:

The meeting began with a welcome from the RU, the introduction of attendees (Attachment 1) and a review of the meeting agenda. The meeting agenda included:

- Status of topical meeting open issues
- Hydrogen monitoring
- Cesium (Cs) storage vessel cooling
- Chemical hazard integrated safety management (ISM) process
- Radiological ISM process, standards selection
- NOx control

The RU noted that there may not be enough time to discuss the NOx control issue in this meeting. If that were the case, the discussion of NOx would be rescheduled. The RU then went over the transition issues since the May topical meeting. The transition issues included the following:

- A level 1 meeting in preparation for the June topical meeting was held on June 6, 2000.
- A topical pre-meeting between the RU and BNFL was held on June 13, 2000.

- The third RU progress letter on the status of topical meetings was issued on June 14, 2000.
- A partial June topical meeting submittal was received by the RU on June 15, 2000.
- BNFL review comments on the April topical meeting minutes were received by the RU on June 16, 2000.
- The May topical meeting minutes were issued by the RU on June 22, 2000.

Status of ISA Open Issues and Questions

Fourteen of the 133 original ISA open issues and questions remain open. The fourteen open issues and questions include:

Q. 31, Q. 92, A2, A3, A8, A9, A15, A18, C30, D10, D11, D12, D13, D15

Status of Topical Meeting Action Items

Thirteen items remain open. Eleven items are identified by the BNFL letter, dated June 15, 2000. Two additional action items are identified in the May 2000 topical meeting minutes.

Significant Unresolved Issues from the Topical Meetings

Fourteen of fifteen issues remain open.

The 15 issues are identified in the RU letter dated June 19, 2000. Issue no. 10, concerning iodine 129, was closed previously. Four issues are partially closed. The partially closed issues include:

- 4.1, 4.2, 4.4
- 5.1, 5.2, 5.3
- 11.1
- 13.3

BNFL Review Comments on the April 2000 Meeting Minutes

The RU accepted the following clarifications to the April 2000 meeting minutes from BNFL:

- Page 5, last set of bullets, revise the first bullet as follows: Decontamination (*general).*
- Page 5, last set of bullets, add a new bullet as follows: *Elution of ion exchanger resin.*
- Page 6, first set of bullets, revise the first bullet as follows: Decontamination (*both canister specific and general).*
- Page 6, second set of bullets, third, sixth, and eighth bullet, BNFL stated that it is not planning to prepare risk assessment calculations for purely chemical hazards. The chemical hazards mentioned in those bullets were already identified in the BNFL ISM Cycle 2 process.

- Page 6, revise the fourth bullet as follows: Are all *glass former* chemical transfer lines underground? All glass former transfer lines will be above the ground. All glass formers will share one common transfer line.
- Page 6, revise the seventh bullet as follows: What concentration of nitric acid will be used to remove resin stuck in the ion exchangers? *Resin dissolution reagents are being researched. 5M nitric acid shows promise for Cs resin dissolution but it is not effective for Tc resin dissolution*
- Page 6, revise the eighth bullet as follows: Has BNFL evaluated the potential hazards associated with a misdirected routing of chemicals? *Yes, multiple mis-routings are recorded in ISM record..*
- Page 6, revise the ninth bullet as follows: Why didn't BNFL use one dedicated line for each chemical instead of sharing one line for different chemicals in its bulge system? *There is only one chemical being routed through the bulge at a time. Multiple lines will provide multiple back flow paths. A common line provides cost savings and is ALARA for maintenance activities.*
- Page 6, revise the tenth bullet as follows: Where are all residual chemicals drained to in a bulge? *There will be no residual chemicals left in a bulge. The common line will be purged and rinsed into the process tank after use. The bulge drain flows to the plant wash tank.*
- Page 6, revise the eleventh bullet as follows: Is it possible some transfer pipes may contain different chemicals? All the chemical transfer lines are dedicated ones until they reach a reagent bulge. Once the transfer pipes reach the bulge, some lines may contain different chemicals at different times. *Also, see the previous bullet.*
- Page 7, second bullet, revise as follows: How does truck delivery of chemicals occur? At the glass formers storage area, *deliveries will be made during approximately 90% of day shift*. At the storage facility of wet chemicals, *deliveries will be made during approximately 75% of day shift.* It will take about 20 minutes for a truck to complete a delivery.
- Page 7, last paragraph, revise the sixth sentence as follows: "The estimated concentration … and 166 m receptors) is above industrial…"
- Page 7, last paragraph, revise the eighth sentence as follows: "BNFL stated that it has submitted an ABAR…"

<u>BNFL Presentation</u>

After this introduction by the RU, the BNFL portion of the program began. The BNFL agenda included a discussion of close-out of open issues (Attachment 2), pretreatment (PT) facility hydrogen monitoring (Attachment 3), cooling and water makeup for concentrate vessel V13073 (Attachment 4), chemical safety at waste treatment plant (WTP) (Attachment 5), summary of preliminary ISM Cycle 2 design basis events (DBEs), High Level Waste (HLW) molten glass spill hazard (Attachment 6), summary of preliminary ISM Cycle 2 DBE/standards selection, and HLW feed vessel breach of containment (Attachment 7).

Close-out of Open Issues

BNFL provided the status of the significant unresolved issues that had been identified by the RU in the letter dated June 19, 2000. The following topics were discussed:

- Criticality
- Explosion Hazards-hydrogen monitoring
- Fire protection
- Design safety features (DSF)
- Dose assessment
- Emergency response plan
- Seismic analysis-seismic PRA
- Research and test (R & T) data quality
- Explosive hazards 1 and 2
- Cesium storage tank cooling
- ISM Cycle 1
- Chemical hazards
- ISM Cycle 2

BNFL stated that the remaining DSF open issue requires a determination of uncertainty ranges for initiating frequency and consequence calculations. The information would be provided in the preliminary safety analysis report (PSAR). The seismic PRA is scheduled to be addressed in the July 2000 topical meeting. On the issue of dose assessment, BNFL stated it will revise its dose consequence methodology to delete the need for the Sellafield database reference. BNFL stated it has revised the August and September 1999 topical reports of explosive hazards 1 and 2 and the reports are being reviewed by the RU. On the issue of ISM Cycle 1, BNFL stated the remaining issues are criticality and chemical hazards, which will be addressed later in the meeting. On the issue of ISM Cycle 2, BNFL will demonstrate later in the meeting how the ISM process was used in the selection of DBEs and standards.

BNFL stated that criticality has been addressed by four interim criticality safety analyses (ICSAs). The ICSAs concluded that if the feed is within the contract specifications, the fissile material is sufficiently dilute so that criticality is not possible. BNFL stated that the ICSAs will be revised to address RU comments and changes in the facility design. The final report on criticality will be completed on July 31, 2000 and is intended to close out the criticality issue.

BNFL stated that the three open issues involving the fire protection include:

- Use of automatic sprinklers
- Structural steel fireproofing
- Hanford fire department interface

BNFL stated that except for C5 areas, most areas will have automatic sprinklers. Pending justification by the BNFL fire hazard analysis (FHA) and RU approval, sprinklers may be omitted in certain areas. Based on the size of the BNFL process buildings and uniform building code (UBC) 97 requirements for fire-resistive construction, BNFL stated that global fireproofing is mandated. However, BNFL emphasized that it believes verbatim compliance with global fireproofing may not be warranted by hazards and BNFL's architects are preparing an equivalency proposal as permitted by UBC. The BNFL interface with the Hanford Fire Department is currently not being resolved pending the revision of the River Protection Project-Waste Treatment Plant (RPP-WTP) contract.

BNFL stated a draft RPP-WTP emergency response plan (ERP) has been submitted to the Department of Ecology, State of Washington as a part of the BNFL dangerous waste permit application (DWPA). BNFL noted that the draft ERP is consistent with Hanford ERP 94-02 and has addressed the RU comments. As a part of PSAR submittal, the draft ERP will be updated by BNFL to address the following areas: emergency action levels, consequence assessment, protective actions, arrangements with Hanford emergency services, and feedback from DWPA.

On the issue of R & T data quality, BNFL stated that it is preparing a plan that will outline the requirements and processes to identify where qualified data are required. BNFL will also develop procedures to implement quality acceptance requirement document (QARD) requirements and review the R & T data generated thus far as an input to the development of these procedures.

The following are the exchanges between the RU and BNFL on this subject. RU comments and questions are followed by the BNFL response:

- What is the basis for not including chemical hazards in the BNFL risk goal calculation? BNFL's interpretation of DOE-top level radiological, nuclear, and process safety standards and principles (DOE-96-0006) is that the risk goal calculation for the RPP-WTP facility is required for radiological hazards only.
- When will the FHA be completed? The FHA will be submitted with the PSAR.
- When will the fire equivalency proposal be completed? The proposal will be completed by Sept. 31, 2000.
- The RU commented that the issue of fire protection can not be resolved until the FHA is completed. How will BNFL ensure that the final FHA is acceptable as a part of the construction authorization request (CAR) submittal? The equivalency proposal along with the preliminary FHA pilot sections in the PT will provide high confidence that the final FHA will be acceptable as a part of the CAR approval process.
- What is the cost of fireproofing the facility? About 6 million dollars.
- BNFL noted that fireproofing is possible if the final FHA proposing limited structural steel fireproofing is not acceptable.
- BNFL emphasized that its ERP is in compliance with the Hanford ERP (DOE/RL-94-02)

and the standards referenced in the Hanford ERP. However, BNFL's compliance with the referenced standards is only with those aspects related to emergency management, not the entire contents.
- How does BNFL assess the validity of data? BNFL has established procedures to do that.
- Is CFR 831.120 (project quality assurance requirements) implemented by BNFL to collect data? Yes.

PT Hydrogen Monitoring

BNFL stated that its current control strategy of hydrogen hazards is to use the process vessel vent system (PVVS) to provide adequate airflow for vessels to dilute potential hydrogen generation. The key elements of the BNFL strategy can be summarized as follows:

- Highly reliable extract fans will be designed to draw purge air into vessels. The hydrogen concentration of vessels will be maintained at less than 25% of LFL at all times.
- Air inlet flow is provided via 8 headers. The design airflow rate will be much higher than minimum hydrogen purge.
- Flow balance design has been supported by modeling and will be verified during commissioning.
- Airflow to vessels will be monitored continuously and alarmed.
- Direct hydrogen monitoring is not considered by BNFL to be either practical or effective.
- Airflow measurements to assure low hydrogen concentrations will be used in place of direct hydrogen monitoring to satisfy the requirements of national fire protection association (NFPA) 69.
- Airflow measurement provides the maximum response time for corrective action.

BNFL further stated that the direct continuous on-line monitoring of hydrogen concentration has certain limitations. These limitations are outlined in the attachment.

The following are the exchanges between the RU and BNFL on this subject. RU comments and questions are followed by the BNFL response:

- How many vessels require the airflow? About 51 vessels in the PT facility.
- What is the flow model used by BNFL to balance the flow? The flow model was developed by Fauske & Associates on December 1999. It is a steady state simulation, using PIPENET software.
- Was the flow model validated? Yes, by Fauske & Associates.
- What is the design flow rate for each vessel? The airflow will be designed to be at least 150% to 200% higher than the minimum air purge requirement, which is defined as a flow to keep hydrogen concentration below 25% of LFL for each vessel. During normal operations, the airflow is likely to be about 10 times of minimum purge flow.
- How many flow meters will there be? There will be about 35 flow meters installed for 35

vessels.

- How is airflow controlled to each vessel? Dampers will be used to control flow.
- Will there be sample lines in vessel dome space? Such sample lines are not being planned.
- BNFL mentioned in previous meetings that it may consider direct hydrogen monitoring during the start-up operation. Is that still valid? No, BNFL currently has no plan to do that.
- The RU commented that it appears that BNFL did not clearly present how the ISM process was used to identify the control strategy for hydrogen hazard. The reliability requirements for the current BNFL hydrogen control strategy were not provided.

<u>Cooling & Water Makeup for Concentrate Vessel V13070</u>

BNFL first showed a flow process diagram for Cs/Tc concentration process. The Cs/Tc concentrate storage vessel, V13070, collects eluates from the PT ion exchange process. These eluates are concentrated by evaporation prior to storage and are fed to the HLW vessel for ultimate incorporation into HLW glass product. Because of the decay heat that will be stored in V13073, the vessel will need periodic water makeup to replace evaporation losses. Assuming all Cs in Envelope B waste were stored in the concentrate vessel, BNFL estimated the decay heat to be 61 kilowatts. This decay heat of 61 kilowatts was used by BNFL as the basis for calculating cooling requirements, evaporative loss, and water makeup requirements. BNFL stated that ISM Cycle 2 identified the loss of water makeup to V13073 as a potential safety concern. Without water makeup, evaporative losses would result in increased concentration of Cs salts, leading to crystal formation and potential damage from hot spots in the vessel. Loss of normal active cooling was not identified by BNFL as a safety issue.

BNFL stated that a study has been completed on methods of active cooling and the results will be issued in June 2000. The calculation of water makeup requirements is under way at BNFL. BNFL stated two scenarios are being considered. One is the normal active cooling to maintain the vessel temperature at 140 F. The other scenario considers prolonged loss of active cooling and loss of normal water makeup. Such a situation would be expected following the loss of site power. This work is expected to be completed by BNFL in July 2000.

The following are the exchanges between the RU and BNFL on the subject. RU comments and questions are followed by the BNFL response.

- What is the size of the concentrate vessel, V13073? The vessel is about 12,000 gallons. The vessel will be filled to about two-thirds (8000 gallons).
- How is the amount of water makeup determined? The amount is estimated based on evaporative losses.
- How does BNFL determine the amount of entrainment going into the PVVS if concentrate boils? The estimate of entrainment due to boiling is still being evaluated. However, HEPA filters will be designed to carry the loading regardless of the entrainment amount.

- What is the hazard of Cs salt crystal formation? The crystals could cause local over-heating and accelerate the corrosion of the vessel.
- Why is caustic added to the Tc eluate evaporator? To control the PH in the evaporator.

Chemical Safety at WTP

BNFL stated that the intent of this discussion was to use the LAW 5 M sodium hydroxide reagent system as an example to demonstrate:

- Determination of important to safety (ITS) designation
- Incorporation of principles of defense in depth to system design and operation
- Application of the best industry practice to the system design

These three issues were raised by the RU after the April 2000 topical meeting on chemical hazards. BNFL stated that it uses the ITS criteria proposed in the BNFL authorization basis amendment request (ABAR-00-00013) for the ITS determination, i. e., ERPG 2 for the public, ERPG 3 for co-located workers, and fatality or in-patient hospitalization for three workers. Based on these criteria, the 5 M NaOH storage and distribution system piping is not designated as ITS.

BNFL stated the defense in depth principles were defined in the top level DOE standards and in the BNFL safety requirements document (SRD). For this example, the implementation of these principles by BNFL is described in the attachment.

BNFL stated that its control strategies and design standards are developed for chemical hazards in the same ISM process as for radiological hazards, using the best industry practices as minimum criteria. BNFL used a LAW caustic spill as an example to demonstrate its standard selection process for chemical hazards. The hazardous situation selected (CSD-L600/0014) was caustic spill and potential worker exposure. The identified control strategy elements included vessel design, piping design, secondary containment of vessel contents, leak detection, routine surveillance, and personal protective equipment. Based on these elements, the resulting safety case requirements (SCRs), safety design requirements, and the safety design features were derived. They are described in the attachment. BNFL selected the following industry standards and guidelines to meet the requirements:

- Uniform fire code (1997), article 80
- Guidelines for Engineering Design for Process Safety by American Institute of Chemical Engineers
- Caustic Soda Handbook by Occidental Chemical Corp.
- Manufacturing/Suppliers Guidelines recommended by Great Western Chemical Co.
- OSHA Standards Interpretation and Compliance Letters
- API 620, 650, and ASME Boiler and Pressure Code, Section VIII, Division I for tanks
- ASME B31.3 for piping.

The following are the exchanges between the RU and BNFL on this subject. RU comments and questions are followed by the BNFL response.

- What material is used for piping? The selection has not been made.
- Other than the NOx release, what other chemical hazards are considered to be DBEs? DBEs include events related to nitric acid spills.
- Why did BNFL select an example of a chemical hazard with below the threshold consequence to demonstrate the standard selection process? The same standard selection process will be applied regardless of the consequences presented by hazards.

Summary of Preliminary ISM Cycle 2 DBE, HLW Molten Glass Spill Hazard

BNFL used the HLW molten glass spill as an example to demonstrate its standard selection process at the HLW facility. The identified DBE for this hazardous situation was CSD-H210/N0036, which was described as a failure of the refractory package. The identified elements for the control strategy included secondary confinement (melter shell) and C5 ventilation for filtration and depression. One identified safety case requirement to incorporate these elements was SCR-HPIPN/N0001, which stated that piping and vessels shall be designed appropriately to ensure confinement for minimum plant design life. Based on this functional requirement, the melter shell design requirements and design features to meet these requirements were identified. They are described in the attachment. Following standards were listed by BNLF as potentially applicable standards for the melter shell design:

- AISC Manual of Steel Construction
- ANSI/AISC N690 Standard for Steel Safety-related Structures for Nuclear Facilities
- ASTM Standards for Materials
- ASME Boiler and Pressure Vessel Code, Sections II, VIII and IX
- American Welding Society D1.1and D1.6

After evaluating these standards, BNFL concluded that:

- Different standards may be selected for different components of the melter shell.
- The selection of AISC standards would require added quality features to ensure reliability.
- The ASTM and AWS standards referenced will be used to ensure material and weld quality.

The second identified safety case requirement by BNFL to incorporate the control elements was SCR-HVENT/N0001, which states that C5 exhaust will be filtered to acceptable limits prior to discharge to the environment. The design requirements based on this SCR are described in the attachment. The following standards were listed by BNFL as potentially applicable standards for the filtering requirements:

- ASME AG-1 Code on Nuclear Air and Gas Treatment
- ASME N509 Nuclear Power Plant Air Cleaning Systems
- ASME N510 Testing of Nuclear Air Cleaning Systems
- DOE STD 3020 HEPA Specification for DOE Contractors
- DOE STD 3022 Testing of HEPAs

ASME AG-1 was selected by BNFL as the most appropriate standard to implement the filtering requirement.

The third identified safety case requirement to incorporate the control elements was SCR-HVENT/N0003, which stated that cascade airflow should be maintained from areas of lower contamination to areas of high contamination. To meet the SCR, fans, ductwork, dampers, and filter housing of C5 exhaust system should meet certain design requirements. These requirements are described in the attachment. After the evaluation, BNFL determined that ASME AG-1 and ASME N509 were the appropriate standards to meet the design requirements.

The following are the exchanges between the RU and BNFL on this subject. RU comments and questions are followed by the BNFL response.

- Is the same standard selection process used for both chemical and radiological hazards? Yes.
- What does “PFD” stand for? It is probability of failure on demand.
- Is the melter shell in the Savannah River Waste Treatment Plant made of Hastelloy? BNFL did not know.
- Does Duratek have any operating experience with Hastelloy? BNFL did not know.
- Is there any standard for the melter? No.
- BNFL indicated that the only U. S. standard to deal with air and gas treatment in nuclear power plants is ASME AG-1. All standards selected by the ISM teams were reviewed by the BNFL project safety committee (PSC). The selected standards were also compared with those in the SRD.
- The RU commented that the integration of the standards selection process with control strategy selection was not presented clearly in this BNFL presentation.

<u>Summary of Preliminary ISM Cycle 2 DBE/Standards Selection, HLW Feed Receipt Vessel Breach of Containment</u>

BNFL provided the HLW feed receipt vessel containment breach as another example to demonstrate its standard selection process. The identified hazardous situation was CSD-P210/N0040. The control strategy elements for this hazard included vessel integrity, cell integrity, cell filtration, and radiation monitoring. The corresponding identified safety case requirements for the control elements included SCR-PPIPN/N0001 for vessel integrity, SCR-PSTR/N0001 for cell integrity, SCR-PVENT/N0001 for cell filtration, and SCR-PRAD/N0001 for radiation monitoring. The functional requirements for these SCRs are described in the attachment. Because the consequence of unmitigated breach was Severity Level 1 category for workers, co-located workers, and the public, the containment vessel, the PT building structure, filter and filter housing, and radiation monitors were all classified as important to safety (ITS) systems, structures, and components (SSCs). The standards selected by BNFL for vessel, cell structure, and radiation monitoring to implement the requirements of the control strategy elements are listed in the attachment.

The following are the exchanges between the RU and BNFL on this subject. RU comments and questions are followed by the BNFL response.

- What is most common cause of a vessel failure? The vessel is not used for the intended purpose.
- BNFL emphasized that ASME Boiler and Pressure Vessel Code, Section III was selected only for dealing with stress concerns of vessel design. It will not be used for other aspects of vessel design because the stringent requirements in ASME Boiler and Pressure Vessel Code, Section III are very expensive to implement and are not necessary in order to achieve adequate safety in this application in BNFL's view.

The RU Evaluation of the Topical Meeting

The Regulatory Official made the following comments at the conclusion of the meeting:

- BNFL still needs to make the case that re-concentration of fissile material and a resulting criticality during facility operations are not credible.
- It appears that the fire protection issue needs attention. The closure of open issues is tied to the submittal and approval of the FHA.
- Although there may not be an agreement on the need of hydrogen monitoring, BNFL may have a defendable position if it can be supported by the ISM process.
- BNFL is making progress in explaining its standards selection process. However, the integration of the selected standards with control strategies is still not presented clearly.

INFORMATION EXCHANGES

1. The RU meeting presentation material
2. BNFL handout on Close-out Issues
3. BNFL handout on PT Hydrogen Monitoring
4. BNFL handout on Cooling and Water Makeup for Concentrate Vessel V13073
5. BNFL handout on Chemical Safety at WTP

6. BNFL handout on Summary of Preliminary ISM Cycle 2 DBE, HLW Molten Glass Spill Hazard
7. BNFL handout on Summary of ISM Cycle 2 Preliminary DBE/Standards Selection, HLW Feed Receipt Vessel Breach of Containment

ATTACHMENTS:

1. The meeting attendance list
2. BNFL handout on Close-out Issues
3. BNFL handout on PT Hydrogen Monitoring
4. BNFL handout on Cooling and Water Makeup for Concentrate Vessel V13073
5. BNFL handout on Chemical Safety at WTP
6. BNFL handout on Summary of Preliminary ISM Cycle 2 DBE, HLW Molten Glass Spill Hazard
7. BNFL handout on Summary of ISM Cycle 2 Preliminary DBE/Standards Selection, HLW Feed Receipt Vessel Breach of Containment